

Claims

- 1.(currently amended) Low expansion transparent glass-ceramics obtained by heat treating a base glass containing 3 - 15% ZnO in mass % based on the total amount of oxides present and which is produced at a melting temperature of 1530°C or below, said glass-ceramics containing β -quartz or β -quartz solid solution as a predominant crystal phase and 50% - 60% SiO₂ in mass % on the basis of amount of total oxides, being free of K₂O and Na₂O, having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T₈₀) of 700nm or below.
2. (original) Low expansion transparent glass-ceramics as defined in claim 1 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.
3. (original) Low expansion transparent glass-ceramics as defined in claim 1 having a heat resisting temperature of 800°C or over.
4. (original) Low expansion transparent glass-ceramics as defined in claim 1 having Young's modulus of 90 GPa or over.
5. (original) Low expansion transparent glass-ceramics as defined in claim 1 containing 1.5% - 3.5% Li₂O in mass % on the basis of amount of total oxides.
6. (original) Low expansion transparent glass-ceramics as defined in claim 1 wherein amount of eluting lithium ion is less than 0.0050 $\mu\text{g}/\text{cm}^2$.
7. (original) Low expansion transparent glass-ceramics as defined in claim 1 containing 3% - 6% TiO₂ in mass % on the basis of amount of total oxides.
8. (original) Low expansion transparent glass-ceramics as defined in claim 1 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

9. (original) Low expansion transparent glass-ceramics as defined in claim 8 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

10. (original) Low expansion transparent glass-ceramics as defined in claim 8 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

11. (original) Low expansion transparent glass-ceramics as defined in claim 1 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

12. (currently amended) Low expansion transparent glass-ceramics as defined in claim 1 comprising in mass % on the basis of amount of total oxides:

| | |
|--|---------------------------|
| Al ₂ O ₃ | 20 - 30% |
| MgO | 0.5 - 2% |
| CaO | 0.5 - 2% |
| SrO | 0 - 10% |
| BaO | 1 - 5% |
| ZnO | <u>0.5</u> <u>3</u> - 15% |
| Li ₂ O | 1.5 - 3.5% |
| TiO ₂ | 3 - 6% |
| ZrO ₂ | 1 - 5% |
| Nb ₂ O ₅ | 0 - 5% |
| La ₂ O ₃ | 0 - 5% |
| Y ₂ O ₃ | 0 - 5% |
| As ₂ O ₃ and/or Sb ₂ O ₃ | 0 - 2%. |

13. (withdrawn) Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530° or below, said glass-ceramics containing β-quartz or β-quartz solid solution as a predominant crystal phase and 50% - 60% SiO₂ in mass % on the basis of amount of total oxides and 1% – 5% BaO in mass % on the basis of amount of total oxides, having an average linear thermal expansion coefficient (α) within a range

from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T_{80}) of 700nm or below.

14.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

15.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 having a heat resisting temperature of 800°C or over.

16. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 having Young's modulus of 90 GPa or over.

17. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 containing 1.5% - 3.5% Li_2O in mass % on the basis of amount of total oxides.

18.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 wherein amount of eluting lithium ion is less than $0.0050\mu\text{g}/\text{cm}^2$.

19.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 containing 3% - 6% TiO_2 in mass % on the basis of amount of total oxides.

20.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

21.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 20 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

22. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 20 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

23.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

24. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 13 comprising in mass % on the basis of amount of total oxides:

| | |
|--|------------|
| Al ₂ O ₃ | 20 - 30% |
| MgO | 0.5 - 2% |
| CaO | 0.5 - 2% |
| SrO | 0 - 10% |
| ZnO | 0.5 - 15% |
| Li ₂ O | 1.5 - 3.5% |
| TiO ₂ | 3 - 6% |
| ZrO ₂ | 1 - 5% |
| Nb ₂ O ₅ | 0 - 5% |
| La ₂ O ₃ | 0 - 5% |
| Y ₂ O ₃ | 0 - 5% |
| As ₂ O ₃ and/or Sb ₂ O ₃ | 0 - 2%. |

25.(currently amended) Low expansion transparent glass-ceramics obtained by heat treating a base glass containing 3% - 15% ZnO in mass % based on the total amount of oxides present and which is produced at a melting temperature of 1530°C or below, said glass-ceramics containing 50% - 60% SiO₂ in mass % on the basis of amount of total oxides and 1.5% - 3.5% Li₂O on the basis of amount of total oxides, being free of K₂O and Na₂O, having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T₈₀) of 700nm or below.

26. (original) Low expansion transparent glass-ceramics as defined in claim 25 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

27. (original) Low expansion transparent glass-ceramics as defined in claim 25 having a heat resisting temperature of 800°C or over.

28. (original) Low expansion transparent glass-ceramics as defined in claim 25 having Young's modulus of 90 GPa or over.

29. (original) Low expansion transparent glass-ceramics as defined in claim 25 wherein amount of eluting lithium ion is less than 0.0050 μ g/cm².

30. (original) Low expansion transparent glass-ceramics as defined in claim 25 containing 3% - 6% TiO₂ in mass % on the basis of amount of total oxides.

31. (original) Low expansion transparent glass-ceramics as defined in claim 25 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

32.(original) Low expansion transparent glass-ceramics as defined in claim 31 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

33. (original) Low expansion transparent glass-ceramics as defined in claim 31 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

34.(original) Low expansion transparent glass-ceramics as defined in claim 25 containing a total amount of R' ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

35. (currently amended) Low expansion transparent glass-ceramics as defined in claim 25 comprising in mass % on the basis of amount of total oxides:

| | |
|--------------------------------|----------|
| Al ₂ O ₃ | 20 - 30% |
| MgO | 0.5 - 2% |
| CaO | 0.5 - 2% |

| | |
|--|---------------------------|
| SrO | 0 ~ 10% |
| BaO | 1 ~ 5% |
| ZnO | <u>0.5</u> <u>3</u> ~ 15% |
| TiO ₂ | 3 ~ 6% |
| ZrO ₂ | 1 ~ 5% |
| Nb ₂ O ₅ | 0 ~ 5% |
| La ₂ O ₃ | 0 ~ 5% |
| Y ₂ O ₃ | 0 ~ 5% |
| As ₂ O ₃ and/or Sb ₂ O ₃ | 0 ~ 2%. |

36. (withdrawn) Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530°C or below, said glass-ceramics containing 50% - 60% SiO₂ in mass % on the basis of amount of total oxides, 1.5% - 3.5% Li₂O on the basis of amount of total oxides and 1% - 5% BaO in mass % on the basis of amount of total oxides, having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T₈₀) of 700nm or below.

37. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

38. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 having a heat resisting temperature of 800°C or over.

39. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 having Young's modulus of 90 GPa or over.

40. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 wherein amount of eluting lithium ion is less than 0.0050 $\mu\text{g}/\text{cm}^2$.

41.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 containing 3% - 6% TiO₂ in mass % on the basis of amount of total oxides.

42.(withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

43. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 42 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

44. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 42 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

45. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

46. (withdrawn) Low expansion transparent glass-ceramics as defined in claim 36 comprising in mass % on the basis of amount of total oxides:

| | |
|--|-----------|
| Al ₂ O ₃ | 20 - 30% |
| MgO | 0.5 - 2% |
| CaO | 0.5 - 2% |
| SrO | 0 - 10% |
| ZnO | 0.5 - 15% |
| TiO ₂ | 3 - 6% |
| ZrO ₂ | 1 - 5% |
| Nb ₂ O ₅ | 0 - 5% |
| La ₂ O ₃ | 0 - 5% |
| Y ₂ O ₃ | 0 - 5% |
| As ₂ O ₃ and/or Sb ₂ O ₃ | 0 - 2%. |